What are Toxic Substances?

Toxic substances can be defined as broad group of chemicals capable of causing harm to plants and animals including humans. There are several classes of toxic substances that have the potential to affect surface waters in Vermont. While many Vermonters are aware that toxic mercury contaminates fish and fish-eating wildlife, there are many other types of toxic compounds that merit attention in this Strategy. For the purposes of this Strategy, toxic compounds have been grouped into five categories: atmospherically-deposited compounds; organic and inorganic contaminants that result from industrial, manufacturing or other point and non-point discharges from facilities; pesticides; contaminants of emerging concern (CECs); and biological contaminants. These groupings reflect the commonality of management options that are applied to address each contaminant group.

Groups of toxic substances:

Atmospheric: *contaminants that are emitted to the atmosphere and deposited upon Vermont's watersheds.*

Organic / Inorganic Contaminants *(PCBs, PAHs, Heavy Metals): that are directly or indirectly discharged from municipal and industrial wastewater treatment facilities, hazardous waste sites, landfills, stormwater runoff, and historic or ongoing discharges from manufacturing, fuel and roads.*

Pesticides: *insecticides, herbicides, fungicides, algicides, biocides used to control nuisances or pests that are applied to land or directly to waters.*

Contaminants of Emerging Concern (CECs): *mostly unmonitored and unregulated chemicals which have been recently "discovered" in wastewater discharges, ambient receiving waters, and drinking water supplies (e.g. pharmaceuticals, personal care products, industrial and household compounds, nano-technology products)*

Biological: *toxic compounds that are produced in nature (e.g. cyanotoxins)*

Mercury is the most well-known atmospherically-deposited contaminant. Mercury, a heavy metal, is emitted to the atmosphere by a wide variety of emissions sources, is readily bioaccumulated to hazardous levels in fish and fish-eating wildlife, and is a pollutant of global impact and concern. Mercury contamination has been widely studied in Vermont and New England. Other heavy metals (such as cadmium or vanadium) and certain "organic" contaminants (e.g., pesticides, dioxins) can also be atmospherically-deposited, although very few instances of this type of contamination have been documented in Vermont.

Organic and inorganic contaminants from municipal and industrial discharges, hazardous waste sites, landfills, storm water runoff comprise a wide variety of toxic constituents. Historically, compounds such as PCBs, or furans and dioxins were used in a variety of manufacturing applications. These compounds are now banned from use and only exist as "legacy" contaminants. Metals have also regularly been used in manufacturing (e.g., electroplating), and historically were commonly released to the environment. Facilities that store, distribute, or sell fuels may be sources of polycyclic aromatic hydrocarbons, which can contaminate groundwater and sediment. Mining is another source of metals that has localized effects in Vermont. Federal and State legislation and associated programs have addressed these sources in Vermont to a large degree, although legacy contamination persists. Road maintenance can result in discharges of toxic pollutants such as chloride and hydrocarbons to surface waters.

Toxic Substances

Pesticides are regularly used in Vermont, subject to regulation jointly by the Agency of Agriculture, and Department of Environmental Conservation, with assistance from the Department of Health. Cooling towers excepted, the largest usage of pesticides is in the agricultural sector, with lesser usage in smaller land uses, such as golf courses, urban grounds maintenance, railroad tracks, utility corridors, roadside guardrail maintenance, aquatic nuisance control, and forestry. The largest category of unregulated pesticide use is among private applicators and homeowners, who apply herbicides, insecticides, and fungicides to lawns, gardens and home. There is minimal to no reporting or tracking for private applicators and homeowner use and sales, even though this constitutes a significant portion of pesticides used in Vermont.

The use of traditional herbicides such as the corn herbicide Atrazine has declined somewhat in recent years, in favor of compounds that have much lower recommended application rates, more targeted toxicity, and faster environmental degradation times. This means that these compounds are not as readily released to surface waters, are thought to have lesser impacts, and may degrade faster. Limited research is available on the effects of these new pesticides on aquatic life.

Quick-links

Topic	Appendix B of this Strategy	Other useful Websites
Contaminants of Emerging Concern	click here	NEIWPCC , EPA, USGS
Heavy metals	click here	EPA
Mercury	click here	HBRF
PCBs, dioxin, PAHs	click here	EPA
Pesticides	click here	Agency of Agric.
Cyanotoxins	click here	Dept. of Health

Contaminants of Emerging Concern (CEC) are a group of mostly unmonitored and unregulated chemicals whose potential to impact the beneficial uses of water resources is largely unknown. CECs, which include pharmaceuticals and personal care products (PPCPs), polybrominated diphenyl ethers (PBDEs), veterinary drugs, and industrial and household compounds have been found at trace levels in wastewater discharges, ambient receiving waters, and drinking water supplies. They are pollutants not currently included in routine monitoring programs. PPCPs comprise a diverse group of chemicals including prescription and over-the-counter human drugs, fragrances, sunscreens, and antimicrobials. CECs from pharmaceuticals, antibacterial agents, detergents and cleaning products, personal care products such as soaps, shampoo, sunscreen, cosmetics, insect repellants and others, have been documented in Lake Champlain's tributaries, wastewater, and combined sewer overflows. Vermont's residents are both the source of, and solution to, this issue.

Although many of these compounds occur at very low levels, the potential risk to aquatic organisms due to exposure to CECs in the environment has been identified as a primary concern given that aquatic organisms may be continually exposed to chemicals, even over multiple generations. For humans, consumption of potable water which may contain trace concentrations of various CECs has been identified as one of the primary potential routes of exposure. To date much research has focused on the potential for development of pathogen resistance to antibiotics and endocrine disruption by natural and synthetic steroids. At this time, many unknowns remain regarding the potential for adverse effects on ecological receptors and humans from exposure to CECs in the environment. In some instances, it is combinations of low-level chemicals, as opposed to the occurrence of an individual compound that is of concern. There are 129 priority chemicals currently regulated by the USEPA under the Safe Drinking Water Act and Clean Water Act, but tens of thousands of CECs exist that may potentially require assessment to ensure that impacts to human and ecological health are minimal. The *Precautionary*

Principal, which has been adopted by the European Union as part of two major environmental directives, states that when there are suspected health or environmental concerns, preventative actions should be taken even when there is not a scientific certainty that harm will ensue.

A good example of an emerging class of contaminants with drinking water effects is called perfluorinated compounds (or PFCs). Some PFCs are ubiquitous at very low levels, but one PFC, called PFOA (or perfluorinated octanoic acid), was recently discovered in drinking and surface waters in southwestern Vermont, including North Bennington, Bennington, and Pownal, at levels of human health concern. PFOA is a manufactured PFC used to make household and commercial products that resist heat and chemical reactions, and repel oil, stains, grease and water. These chemicals are widely found in nonstick cookware, stain-resistant carpets and fabrics, water repellant clothing, paper and cardboard food packaging and fire-fighting foam. PFOA does not break down easily and therefore persists for a very long time in the environment, especially in water. Its toxicity and persistence in the environment means it is a potential danger to human health and the environment.

It is known that emerging contaminants undergo chemical reactions during wastewater treatment, and what is released to the environment is not always the same as what was sent into treatment. For example, recent scientific studies suggest that dioxin-like compounds found in sediments may result from chemical waste treatment reactions with triclosan instead of actual dioxins from industrial sources (triclosan is a very common antimicrobial agent contained in soaps and toothpaste). Many CECs are known to have endocrine-disrupting effects. For example, fluoxetine, the active ingredient of the antidepressant Prozac™ has been shown to alter the timing and effectiveness of reproduction in native freshwater mussels, while estrogenic contaminants from wastewater discharges have been linked to feminized male fish in several study areas. In 2009, the Vermont Advisory Committee on Mercury Pollution, under directive from the Vermont General Assembly, prepared a report regarding toxic substances management options for Vermont (http://www.mercvt.org/acmp/reports/2009ACT_report.pdf).

Some biologically-derived toxic compounds occur in Vermont waters. Cyanobacteria formerly known as blue-green algae) are naturally-occurring organisms found in nearly all aquatic and many terrestrial ecosystems. Cyanobacteria are favored by high-nutrient waters, where they may proliferate into thick accumulations known as blooms. In addition to being a nuisance, cyanobacteria may produce cyanotoxins which affect the nervous system or liver. These toxins have been implicated in the deaths of dogs on Lake Champlain and other parts of the country. The presence of dense blooms on Lake Champlain and some inland lakes is of concern because of the human health implications.

How important are Toxic Substances?

Based on the Watershed Management Division's evaluation, toxic substances comprise a moderately ranked stressor. The extensiveness of toxic substances impacts varies depending on the group of compound. For example, mercury contamination is widespread in Vermont. A statistical survey indicates that 25% of lakes in Vermont may exhibit mercury levels in standard-sized yellow perch in excess of EPA guidelines. The most recent statewide water quality assessment indicates that 8,115 lake acres and 68 stream miles are identified as impaired due to mercury. Known areas of PCB contamination of fish or sediment are limited to certain areas within Lake Champlain, and a short list of contaminated sites. Metals create known impairments in ~100 miles of stream, and stress an additional 137 miles, but have not been documented to impact lakes. Only a few studies have been carried out to investigate emerging contaminants in Vermont, most notably in the Lake Champlain Basin. However, a national USGS study of 139 streams from across the country found one or more of the 95 chemicals for which they sampled in

80 percent of the streams. Of the 95 chemicals, only 14 have drinking water standards or other human health or ecological health criteria. No specific research has been done to investigate the potential biological response to emerging contaminants in Vermont. The occurrence of cyanobacteria and associated cyanotoxins is well documented in areas of Lake Champlain, less so in Memphremagog. A few other lakes are also known to exhibit recurring cyanobacteria blooms.

The intensity of impact also varies by contaminant, and whether the toxic substance bioaccumulates or not. Exposure of biota to toxic compounds may be termed acute (where the toxicity impact is immediate and severe) or chronic (where low-level continual exposure elicits a milder and longer-term response). New science also suggests that although low levels of some contaminants may not have detectable toxic responses to biota, the synergistic effects of exposure to multiple low-level compounds simultaneously may have profound impacts.

The duration of effect also varies by contaminant. For some toxic contaminants, such as active metals releases or gasoline spills, the duration of toxic effects may be relatively short. This is because the effects are reduced or eliminated when a fuel spill is addressed, or a release of metals is stopped. Legacy effects can remain in sediments, however. By contrast, certain organic contaminants like dioxins or PCBs will immediately contaminate sediments, and create long-term toxicity to species that live in sediments, or that rely on sediment-dwelling species for their food source. Mercury is intermediate in the duration of effects. In areas where meaningful controls have been implemented, mercury levels in fish and wildlife of nearby ponds has declined in a few years. However, complete control of mercury is a long-term proposition, owing to the global distribution of mercury.

Management strategies are in place to address many of the toxic contaminants, and therefore, the urgency of threat posed by most toxic contaminants is lower than some of the other stressors addressed in the Strategy. However, emerging contaminants, due to the prevalence of sources and many unknowns associated with their distribution, toxicity, and synergistic effects have a high urgency relative to other toxic substances.

What objectives achieved by controlling Toxic Substances?

Managing and preventing toxic substances promotes one major surface water objective:

Objective D. ***Minimize Toxic and Pathogenic Pollution, and Chemicals of Emerging Concern***

Controlling the release of toxic substances also necessarily minimizes exposure to biota and to humans. The Precautionary Principal is a guideline that states that when there are suspected health or environmental concerns, preventative actions should be taken even when there is not a scientific certainly that harm will ensue.

What are the causes and sources of Toxic Substances?

Atmospheric

Atmospheric contaminants are the result of air emissions of toxic substances that occur as a result of a wide variety of energy or industrial applications. Major examples of atmospheric emissions sources include: coal-fired utilities, utility boilers, waste-to-energy incinerators, municipal waste incinerators, smelters, Portland cement facilities, and chlor-alkali facilities. Vermont has few such facilities in-state, although there are several utility boilers. Landfills are also known to emit smaller quantities of toxic contaminants directly into the atmosphere. Crematoria are becoming increasingly recognized as a small-

scale but important source of mercury pollution. Atmospheric deposition of pesticides occurs globally through a variety of processes both during and after application. The relative importance of atmospheric inputs of pesticides to surface waters is dependent on the magnitude of the other sources of pesticides to that water body.

Organic / Inorganic Contaminants

A wide variety of industrial facilities, actively use toxic compounds in the process of manufacturing, and thus have the potential to discharge these compounds. Facility waste is often pre-treated, but then discharged to the local wastewater treatment facility. In many instances the use of toxic chemicals is part-and-parcel of the manufacturing process, and it should not be assumed that all facilities discharge chemicals simply because hazardous substances are used. Discharges from municipal and industrial wastewater treatment facilities may contain toxic contaminants that are controlled to permitted levels. Residual materials (sludges) from wastewater treatment may also contain certain contaminants, the concentrations of which are also regulated. Landfill leachate and hazardous waste sites are also sources of toxic substances. The full extent of the impacts from these sources are not yet well known. There are several Federal and state programs in place to control, reduce and/or eliminate toxic substance releases. The Vermont Toxic Discharge Control Strategy (TDCS) implemented by VTDEC, provides guidance for the implementation of narrative and numeric water quality standards and describes procedures for determining appropriate toxic pollutant criteria when necessary to protect aquatic biota and human health.

The overall goal of implementing the TDCS is to quantify all National Pollution Discharge Elimination System (NPDES) discharges in Vermont and to establish water quality criteria and discharge permit limits that can be used to regulate discharges in a manner that will assure that the state water quality standards and receiving water classification criteria are maintained. A progressively stringent three-tiered effluent characterization process is used for assessing the toxic nature of discharge effluents. The ultimate goal of this process is to determine whether or not a specific discharge has the reasonable potential to cause or contribute to violations of any applicable water quality standards.

Pesticides

Older records of commercial pesticide application from the Agency of Agriculture in Vermont indicate that 144,465 lbs of pesticides were applied in 2007, not including biocides (298,000 lbs) used in cooling towers. Corn herbicides comprised 55% of the pesticides applied followed by golf courses at 13% and electrical utilities at 5%. The corn herbicide atrazine which has declined in use in recent years still comprises 60% of all the corn herbicides applied in 2007. There are minimal to no records or tracking of private applicator or residential homeowner usage in Vermont, but pesticide use and sales surveys conducted in other parts of the country indicate that these users account for a significant portion of all pesticides applied (10-25%). Suburban lawns and gardens often receive heavier pesticide applications per acre than agricultural areas. According to the U.S. Geological Survey (USGS) National Water Quality Assessment (NAWQA) program, pesticides are widespread in streams and groundwater occurring at detectable concentrations more than 90% of the time in urban, agricultural and mixed areas. The USGS has reported that these pesticides are often found at higher concentrations in urban and suburban streams than in agricultural streams.

Contaminants of Emerging Concern

CECs are the most difficult to manage of all the compounds discussed in this Strategy. Many emerging contaminants are the result of necessary products or medications that are part of our everyday lives. Such compounds are used in and released from most Vermont households, hospitals, and businesses on a daily basis. These compounds are either delivered into septic systems, where they may be transferred to

groundwater, or to wastewater facilities, where they are discharged, directly or indirectly, into surface waters. The chemical reactions that occur within septic systems and especially wastewater treatment facilities can alter or transform benign compounds into compounds with known toxic effects.

Biological
Cyanobacteria are found in waterbodies around the world and are a common component of the biological community in Vermont waters. Not all cyanobacteria are capable of producing toxins, nor do they produce toxins at all times. Currently, there is no scientific consensus on what will trigger toxin production in cyanobacteria. Historically, cyanotoxin concentrations of concern in freshwater were primarily associated with dense, often persistent cyanobacterial blooms occurring in waterbodies with high nutrient concentrations, particularly phosphorus. More recently, cyanobacteria blooms have been observed on waterbodies that are not considered eutrophic. New precipitation patterns and increasing water temperatures linked to global climate change may be creating optimal growth conditions for cyanobacteria. Nutrient delivery to waterbodies may also increase as a result of climate change, and it is expected that the incidence of cyanobacteria blooms will increase in the future.

Monitoring and assessment activities to track Toxic Substances

Atmospheric:
The National Atmospheric Deposition Network (NADP) and associated Mercury Deposition Network, Atmospheric Integrated Research Monitoring Network, and Atmospheric Mercury Network are managed by NOAA jointly with other Federal agencies, and are designed to track acidity, nutrients, air contaminants (including heavy metals) and mercury. There are several NADP and related network sites occurring in or near Vermont.

The Ambient Air Monitoring Network is operated by the Department of Environmental Conservation, Air Pollution Control Division (APCD). The network measures lead, volatile organic compounds, and carbonyls among other pollutants outside the scope of toxic substances. There are monitoring stations in Underhill, Burlington, Rutland, and Bennington.

The APCD's Air Toxics Program inventories emissions of toxic atmospheric contaminants from Vermont's emissions sources

The Fish Contaminant Monitoring Committee (FCMC) – an ad-hoc group of scientific staff from DEC, Department of Fish and Wildlife and Department of health share joint responsibility for testing fish tissue for mercury contamination. The ability of this Committee to meaningfully and continuously assess fish mercury levels and track changes over time is limited by resource constraints in each Department. As such the monitoring coverage is spotty at best. In 2006, the Vermont Advisory Committee on Mercury Pollution issued a report, prepared jointly with the FCMC, recommending the optimal design of a fish contaminant monitoring program. The network design recommended in the report has yet to be implemented, resulting in a considerable information and risk assessment gap.

Organic / Inorganic
The Department of Environmental Conservation's Waste Management Division requires monitoring and assessment as part of permit requirements for normal, ongoing facilities operations. Actively operating landfills and solid waste management facilities are regulated as part of the Solid Waste Management Program. Hazardous Wastes are tracked as part of Hazardous Waste Management Program. Sites where legacy pollution may exist, or spills have occurred, including large scale industrial facilities as well as

smaller-scale releases, are assessed under the Sites Management Program. Discharges from industrial and manufacturing facilities are subject to monitoring requirements set forth under the National Pollution Discharge Elimination System (NPDES), which in Vermont is administered by the Wastewater Management Division. EPA is involved in monitoring and assessment work on hazardous sites that become part of the Superfund program. The VTDEC Stormwater Multi-Sector General Permit carries monitoring requirements for facilities that operate under the permit.

Pesticides

The Agency of Agriculture and WSMD collaborate to carry out monitoring of certain waters in the Lake Champlain Basin and Lake Memphremagog for corn herbicides including atrazine and other pesticides used in Vermont. In 2001, a report entitled "Pesticides in the Surface Waters of Chittenden County described how some pesticides are found in Vermont streams. Samples were collected during rainfall events after known commercial pesticide applications and following periods of expected maximum homeowner activity. Turf herbicides in streams adjacent to residential complexes were detected following a commercial landscape application. Pesticides were found in 41 percent of the samples. Two chemicals were found at concentrations that exceeded acute water quality guidelines. The results indicate that pesticides commonly used for turf management are present in streams in developed areas of Chittenden County at certain times. The occurrence of some pesticides above water quality guidelines may pose some risk to aquatic communities in those waters.

Contaminants of Emerging Concern

There have been several efforts to document the occurrence of CECs in Vermont's surface waters, although no routine, on-going monitoring efforts are presently supported. In 2002, VTDEC and USEPA Region I collaborated to collect wastewater effluent samples from 12 municipal wastewater treatment facilities. The facilities were located throughout the state and represented a range of population served, a mix of industrial and domestic input as well as a variety of treatment technologies. Samples were analyzed for six selected CECs: triclocarban, an antifungal and antibacterial agent; 17b-Estradiol, 17a-Ethynylestradiol and Estrone, estrogenic hormones; Bisphenyl-A, used primarily in the production of polycarbonate plastics and epoxy resins; and 4-Nonylphenol, a breakdown product of a widely-used class of plasticizers and nonionic surfactants found in a wide range of products including liquid detergents and cleaning agents. These target compounds represent several classes of PPCP compounds.

The U.S. Geological Survey (USGS) is one of the leaders in PPCP research. In Vermont, USGS has conducted a number of PPCP studies in the Lake Champlain Basin. USGS has analyzed samples of wastewater effluent, combined sewer overflows, urban streams, large rivers, an undeveloped (control) stream, and samples in Lake Champlain in 2006.

An important finding of these studies was that wastewater effluent and combined sewer overflows (CSO) effluent were not the only sources of wastewater contaminants (including CECs). Urban streams contributed substantial amounts of wastewater contaminants to Lake Champlain during storms from untreated sewage sources. Two of the streams studied are underlain by old sewer pipes and combined sewer infrastructure; which may leak during storms, releasing sewage to the streams. These findings are the subject of continuing inquiry by USGS. In general, contaminant concentrations in Lake Champlain were low when evaluated either by total count of detectable contaminants or contaminant-specific concentrations. Nonetheless, caffeine, which is highly removed by wastewater treatment, and thus a good marker for the potential presence untreated wastewater (CECs), was found even in the lake. Researchers

reported the lake to be "mildly caffeinated." The 2009 report "*Wastewater Effluent, Combined Sewer Overflows, and Other Sources of Organic Compounds to Lake Champlain"* presents the most recent findings.

In 2008, DEC partnered with International Business Machines (IBM) of Essex to investigate the occurrence of PPCPs in wastewater effluents and in the surface water from the Winooski River. Eight municipal wastewater treatment facilities on the Winooski River, including the IBM wastewater facility were monitored in 2008 for 85 analytes, representing a diverse array of CECs. Funding for this analysis was provided by IBM.

In response to the identification of PFOA in this area of Vermont, the Department of Environmental Conservation, in partnership with other State and Federal agencies, has mounted a sampling and assessment effort aimed it identifying potential sources of PFOA, to identify if other drinking water sources may be contaminated.

Biological

The Watershed Management Division coordinates a collaborative cyanobacteria monitoring network for the waters of Lake Champlain and inland lakes. The program includes several partner organizations - the Department of Environmental Conservation's Champlain Monitoring Project, the Vermont Department of Health, the Lake Champlain Basin Program, and the Lake Champlain Committee. Cyanobacteria status around the lake is updated weekly during the main recreational period of June to September and available to the public through the Department of Health's webpage. The information is utilized by the Vermont State Parks beaches on Lake Champlain as well as the public water suppliers drawing from the lake.

Water quality monitoring by the DEC's Lakes and Ponds Program assesses the nutrient status of Vermont waters. Because of the link between nuisance levels of cyanobacteria and phosphorus pollution, assessment of phosphorus concentrations around the state will assist in identifying lakes that a higher likelihood of potentially toxic cyanobacterial blooms. In addition, WSMD staff report suspected cyanobacteria blooms observed during their lake visits. Department of Health and Watershed Management Division staff respond to reports of cyanobacteria blooms on inland water bodies and provide assistance to affected towns and property owners.

Priority Next Steps for the Monitoring and Assessment Programs Addressing Toxic Substances

- Maintain a database of waterbodies with reported cyanobacteria blooms and/or cyanotoxins.
- Expand the cyanobacteria monitoring network to additional inland lakes.
- Consider implementation of Advisory Committee on Mercury Pollution recommendations regarding a fish-tissue monitoring program for Vermont.
- Develop a strategy for monitoring / surveying CECs and addressing those that reach a certain threshold of concern
- Evaluate mechanisms to monitor residential pesticide sales as proxy for use

- Develop a routine monitoring and assessment process for municipal and industrial wastewater effluents and receiving waters
- Work with USEPA, USGS, and other State agencies and partners to conduct further CEC monitoring.
- Involve a site manager representative from DEC Hazardous Materials Section, and DEC Solid Waste Section in the meetings as a tactical basin plan is started to address the need for potentially focusing on sediment monitoring, screening salvage yards and other monitoring needs with respect to sites and toxics in that basin. Include new information gained from this collaboration into the CEC strategy (see above under high priority.)
- Assist AAFM to enhance pesticide screening/monitoring
- Evaluate sediments behind dams slated for removal
- Ensure that macroinvertebrate and fish community sampling occurs below known contaminated sites
- Participate in DEC Waste Management Program Remediation of Contaminated Sites document development

Technical assistance programs to address Toxic Substances

Atmospheric
The Compliance Section of APCD, also called the "Field Services Section", ensures that industry, businesses, institutions, and individuals comply with air quality regulations and air pollution control permits issued by the Agency of Natural Resources. The most important activities of the Compliance Section are: Industrial and Commercial Air Pollution Source Inspections; Monitoring of Air Pollutant Source Emission Testing; Complaint Investigations; Issuing Open Burning Permits; and, Control of Vapors from Gasoline Marketing.

Organic / Inorganic
The Pollution Prevention Program is managed by the Compliance and Enforcement Division. The Environmental Assistance Office provides non-regulatory technical assistance for industry, municipalities, and other entities seeking to comply with Vermont's regulations concerning waste management.

Pesticides
The Agency of Agriculture offers technical assistance for licensed pesticide applicators.

CECs
There is limited technical assistance available to support improved efficiency of CEC capture from septic and wastewater. The New England Interstate Water Pollution Control Commission provides a comprehensive training program for wastewater treatment facility operators. As Vermont's wastewater treatment facilities are upgraded, or during the process of permit re-authorization, DEC and EPA should provide technical assistance to municipalities on low-cost means to increase treatment efficiency for release of CEC's.

Biological
The Watershed Management Division offers identification of potential cyanobacteria blooms and provides assistance to lake associations and residents wishing to develop local monitoring activities. The Department of Health provides technical assistance for public entities and private individuals regarding human health and recreational concerns, including testing for two cyanotoxins.

Regulatory programs to address Toxic Substances

Atmospheric
The APCD maintains up to date Air Pollution Control Regulations that comply with EPA's regulations issued under the Clean Air Act. These regulations confer to ACPD regulatory and permitting authority on several air emissions source types that have potential impacts to surface waters, including organic compounds and hazardous air contaminants. APCD maintains Air Quality Standards that are used similarly to Water Quality Standards to limit emissions of air contaminants to safe levels. Depending on the volume emitted, individual permits may be required. APCD also issues a general permits for smaller emissions sources.

Organic / Inorganic
Toxic contaminants from industrial and municipal discharges are regulated by the Wastewater Management Division, under the NPDES discharge permitting program, or the Indirect Discharge Program. Contaminants in wastewater residuals are managed by the Residuals Wastes Program, and regulated under the Solid Waste Management Rules.

Toxic and hazardous materials that are used within industrial and manufacturing facilities are regulated under the Hazardous Waste Management Program, which implements the federal Resource Conservation and Recovery Act for Vermont. Toxic contaminants that have the potential be discharged to surface waters from non-point sources within industrial, municipal, and manufacturing facilities are also regulated by the WSMD's Multi-sector General Permit for stormwater. Old hazardous waste sites stay under the purview of the Sites Management Section of the Hazardous Waste Program until they are officially closed and monitoring has ceased at the site.

Contaminants in landfill leachate are regulated by the Solid Waste Management Program.

Contaminants associated with fuel storage tanks and fuel dispensing facilities are regulated under the Underground Storage Tank Program.

Mercury that is derived from Vermont-specific sources is regulated by the Comprehensive Mercury Management Act (10 V.S.A. Chapter 164).

Contaminants that may be lost from facilities due to stormwater are regulated by the Stormwater Multi-Sector General Permit.

Pesticides
Pesticides are regulated by the Agency of Agriculture (see quick-link above), under 6 V.S.A. Chapter 87. The Agency of Agriculture also implements the Federal Insecticide, Fungicide, and Rodenticide Act. The DEC Watershed Management Division reviews applications and issues permits for pesticide use in lakes and rivers (e.g.lampricides, Sonar). The Vermont Pesticide Advisory Council is in place to promote better pesticide policy and regulatory development.

Contaminants of Emerging Concern
There are very few regulatory programs addressing emerging contaminants in surface waters. The Department of Environmental Conservation is in the process of updating the Groundwater Protection Rule to incorporate standards for PFOA.

Biological
There are no federal or state regulations addressing cyanobacterial toxins. The EPA has developed health advisories for two cyanotoxins in drinking water and has begun development of recreational advisories. Beach closure/reopening guidelines specific to cyanobacteria have been developed by the Vermont Department of Health. These guidelines are voluntary, and while strongly recommended by the Health Department, implementation is the responsibility of beach managers. The Lake Champlain Coalition of Municipal Water Suppliers has developed a voluntary process for responding to cyanobacteria in drinking water supplies and participate in a voluntary cyanotoxin monitoring program each summer.

Funding programs to address Toxic Substances

Atmospheric
There are few funding programs specifically directed towards controlling atmospheric emissions of toxic substances. Individual emitters are required to absorb the cost of emission controls necessary to meet permit requirements. National Oceanic and Atmospheric Administration and Lake Champlain Basin Program – Technical Program grants have been used to research mercury deposition.

Organic / Inorganic
The Waste Management Division offers the following funding options to address toxic substances:

- Municipal Pollution Control, Revolving Loan Fund
- Brownfields Site Assessment Grants
- Environmental Contingency Fund
- Hazardous Wastes Facility Grants
- Landfill Closure Grants
- Petroleum Clean-Up Fund
- Solid Waste Implementation Grants
- Solid Waste Assistance Grants
- Underground Storage Tank Removal
- Underground Storage Tank Replacement/Upgrade

Pesticides
Individual licensed pesticide applicators are required to absorb the cost of measures and controls necessary to meet Vermont and Federal regulatory requirements.

Contaminants of Emerging Concern
- Lake Champlain Basin Program Technical Program Grants
- Lake Champlain Basin Program – US Geological Survey Dedicated Research Funds

Biological
- Lake Champlain Basin Program Technical Program Grants

Information and education programs to address Toxic Substances

Atmospheric
Vermont's principal educational program for mercury is the Mercury Education and Reduction Campaign. ACPD's Air Toxics Program also provides educational materials for other classes of atmospheric contaminants.

Organic / Inorganic
The Environmental Assistance Office coordinates general pollution prevention education for municipalities and regulated facilities and manufacturers.

Pesticides
The Vermont Pesticide Advisory Council is charged with reviewing insect, plant disease, weed, nematode, rodent, noxious wildlife and other pest control programs within the state and to assess the effect of such programs on human health and comfort, natural resources, water, wildlife, and food and fiber production, and where necessary make recommendations for greater safety and efficiency.

Contaminants of Emerging Concern
The New England Interstate Water Pollution Control Commission (see quick-link above), through its regional working groups, coordinates education and outreach about emerging contaminants.

Biological
The DEC (Drinking Water and Groundwater Protection Division and Watershed Management Division) work with the Department of Health to provide training for water suppliers and beach managers focused on recognizing and responding to cyanobacteria. Champlain drinking water suppliers have the opportunity to participate at no cost in a voluntary 12 week cyanotoxin monitoring program each summer. Additionally, DEC and VDH work with water suppliers to develop source water protection plans and determine appropriate treatment processes to prevent cyanobacterial contamination of water processing facilities. The VDH issues annual reminders about cyanobacteria at the beginning of the summer recreational season and maintains an on-line tracking tool to keep the public informed about current conditions around the state. VDH and WSMD have developed a monitoring protocol for local towns and offer training workshops in cyanobacteria identification.